

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

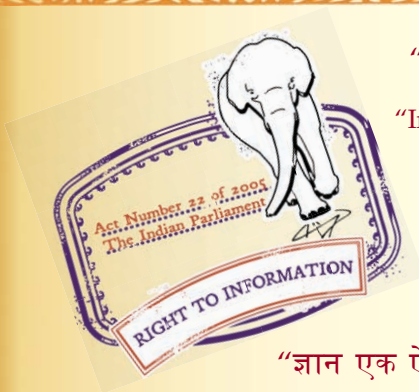
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 9385-3 (1980): High voltage fuses, Part 3: Application guide for high voltage fuses [ETD 39: Fuses]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



IS : 9385 (Part III) - 1980

(Reaffirmed 2002)

Indian Standard

**SPECIFICATION FOR
HIGH VOLTAGE FUSES**

**PART III APPLICATION GUIDE FOR
HIGH VOLTAGE FUSES**

(First Reprint NOVEMBER 1983)

UDC 621.316.923.027.3(026)



© Copyright 1980

INDIAN STANDARDS INSTITUTION

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR HIGH VOLTAGE FUSES

PART III APPLICATION GUIDE FOR HIGH VOLTAGE FUSES

High Voltage Switchgear and Controlgear Sectional Committee, ETDC 58

Chairman

SHRI H. M. PAI

Representing

The Ahmedabad Electricity Co Ltd, Bombay

Members

SHRI B. S. REUBEN (<i>Alternate to</i> Shri H. M. Pai)	
SHRI M. M. BENDRE	Maharashtra State Electricity Board, Bombay
SHRI K. K. BOSE	Calcutta Electric Supply Corporation Ltd, Calcutta
SHRI T. K. GHOSE (<i>Alternate</i>)	
SHRI R. CHANDRAMOULI	Tata Hydro-Electric Power Supply Co Ltd, Bombay
MRS C. BALIGA (<i>Alternate</i>)	
CHIEF ENGINEER	Central Public Works Department, New Delhi
SURVEYOR OF WORKS III (<i>Alternate</i>)	
DEPUTY CHIEF ENGINEER (PS)	Central Electricity Authority, New Delhi
DIRECTOR (<i>Alternate</i>)	
SHRI K. L. GARG	Directorate General of Supplies & Disposals, New Delhi
SHRI B. N. GHOSH	Bharat Heavy Electricals Ltd, Bhopal
SHRI G. P. MITTAL (<i>Alternate</i>)	
SHRI A. RAJA RAO (<i>Alternate</i>)	
SHRI D. P. GUPTA	Directorate General of Technical Development, New Delhi
SHRI JAYANT N. GURJAR	Kirloskar-Asea Limited, Bangalore
SHRI H. V. J. IYENGAR	NGEF Limited, Bangalore
SHRI C. S. N. RAJU (<i>Alternate</i>)	
SHRI P. M. JOSEPH	Aluminium Industries Limited, Kundara
SHRI C. M. A. NAYAR (<i>Alternate</i>)	
SHRI I. C. KUPPUSAMY	Tamil Nadu Electricity Board, Madras
SHRI S. PANNIRSELVAM (<i>Alternate</i>)	
SHRI V. S. MANI	Hindustan Brown Boveri Ltd, Bombay
SHRI K. S. MADHAVAN (<i>Alternate</i>)	
SHRI S. K. MUKHERJEE	National Test House, Calcutta
SHRI P. C. PRADHAN (<i>Alternate</i>)	

(Continued on page 2)

© Copyright 1980

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(Continued from page 1)

Members

SHRI B. S. NARASIMHAN

SHRI V. R. NARASIMHAN

SHRI ANANTHA KRISHNAN (*Alternate*)

SHRI J. S. NEGI

SHRI R. M. NANAVATI (*Alternate*)

DR G. M. PHADKE

SHRI J. N. GURJAR (*Alternate*)

SHRI A. S. PINTO

SHRI S. K. BASU (*Alternate*)

SHRI S. P. RANADE

SHRI S. R. POTNIS (*Alternate*)

- SHRI P. K. SAXENA

SHRI G. L. DUA (*Alternate*)

SHRI A. P. SHENOY

SHRI Y. K. PALVANKAR (*Alternate*)

SHRI S. P. SACHDEV,

Director (Elec tech)

Representing

Mysore Electrical Industries Ltd, Bangalore

Central Power Research Institute, Bangalore

(*Alternate*)

Jyoti Limited, Vadodara

Indian Electrical Manufacturers' Association,
Bombay

Delhi Electric Supply Undertaking, New Delhi

Crompton Greaves Ltd, Bombay

Rural Electrification Corporation Ltd, New Delhi

Bombay Electric Supply and Transport Undertaking,
Bombay

Director General, ISI (*Ex-officio Member*)

Secretary

SHRI K. GANESH

Assistant Director (Elec tech), ISI

Indian Standard

SPECIFICATION FOR HIGH VOLTAGE FUSES

PART III APPLICATION GUIDE FOR HIGH VOLTAGE FUSES

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 16 January 1980, after the draft finalized by the High Voltage Switchgear and Controlgear Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The three classes of high voltage fuses in general use are, the expulsion, liquid and high rupturing capacity cartridge types. These find their most common application on distribution systems up to 33 kV while the liquid and cartridge type fuses are available for use on systems up to 132 kV, largely for protecting voltage transformers.

0.3 This standard (Part III) guide forms a part of a series of standards on high voltage fuses. Requirements and tests for current limiting fuses and expulsion and similar fuses are covered in detail in the preceding parts of this standard.

0.4 The object of this guide is to present standard guidelines on the application, operation and maintenance as an aid in obtaining satisfactory performance with high voltage current limiting and expulsion and similar types of fuses.

0.4.1 Details of selection, installation and maintenance of low voltage fuses for voltages not exceeding 650 V are covered in a separate Indian Standard.

0.5 A fuse in an electric circuit stands guard at all times to protect the circuit in which it has been placed, and the connected equipment(s) from damage within the limits of its rating. The guarantee to its adequate performance depends not only upon the accuracy with which it was manufactured, but also on the correctness of the application and the attention it receives after it had been installed. It is realized hence that proper application guidelines are necessary for the choice and installation of the types of fuses available as also the specifications for their technical requirements. This Indian Standard (Part III) shall be used in conjunction with the other parts of this standard.

IS:9385 (Part III) - 1980

0.6 It is also recommended that the prescribed safety rules shall be observed at all times, when handling or maintenance of fuses near energized equipment or conductors.

0.7 In the preparation of this guide, considerable assistance has been derived from the following publications issued by the International Electrotechnical Commission:

IEC Pub 282 — High voltage fuses:

282-1 (1974) — Current limiting fuses

282-2 (1970) — Expulsion and similar fuses

0.8 In order to facilitate comparison with the international standards and for ease of reference, the committee has decided to add in the form of an Appendix, the major differences between this Indian Standard and the corresponding IEC Publication(s). This standard (Part III) corresponds appreciably with the IEC Publications referred to in 0.7 and there are no major deviations.

1. SCOPE

1.1 This standard (Part III) covers guidelines on application, operation and maintenance of high voltage fuses of the following types:

- a) Current limiting fuses, and
- b) Expulsion and similar fuses.

1.1.1 Fuses for which this guide is intended shall conform to the provisions laid down in Part I and Part II of this standard.

2. APPLICATION

2.0 General — The general guidelines specified in this guide apply to all types of high voltage fuses unless otherwise stated.

2.1 Mounting — Fuses shall be installed in accordance with the manufacturer's instructions. For multipole arrangement of fuses, when the distance between poles is not fixed by the construction, the poles should be mounted with clearances not less than those specified by the manufacturer.

It shall also be noted that owing to external phenomena the performance of these fuse-links may be significantly affected, and hence the safety clearances indicated by the manufacturer shall be adopted.

2.2 Selection of the Rated Current of the Fuse Link — The rated current of a fuse-link is usually higher than the normal service current. Guidelines for selection are usually provided by the manufacturer.

If the current rating of the fuse-link is less than that of the fuse-base the effective current rating of the fuse is that of the fuse-link.

The rated current of the fuse-link shall be selected with due regard to the following parameters:

- a) normal and possible overload currents of the circuit, including sustained harmonics;
- b) transient phenomena in the circuit related to switching such equipment as transformers, motors or capacitors;
- c) co-ordination with other protective devices, if any; and
- d) enclosure of the fuse or other variation in the cooling conditions which may affect the temperature of the fuse-link.

The rated current is defined with reference to the temperature-rise of a fuse-link tests singly in free air. When fuses are used in an enclosure, the current rating may have to be reduced in order that the temperature-rise requirements may still be met, and consequently the fuse-links may have many different current ratings dependent on the type of enclosure. For the short pre-arcing times, generally used in predicting discrimination, the time/current characteristics are not significantly changed by mounting the fuse in such an enclosure.

However, a useful guide for any necessary derating for current limiting fuses can be obtained by consideration of the results of the power-dissipation tests specified in 7.1.2 of Part I of this standard.

In some instances, the fuse-link may have special contacts for mounting of three-fuse-links in a particular enclosure (for example that of a switch-fuse or fused circuit-breaker). In such cases, special tests may be made in the particular enclosure and the current rating for application of the fuse-link inside the enclosure will be given.

NOTE — Fuse-links that are loaded with a current exceeding the rated current for a time longer than that associated with the minimum breaking current may be subject to deterioration that might influence the characteristics and the breaking capability.

2.3 Selection of Rated Voltage

2.3.1 Selection of Rated Voltage of the Fuse-Link of Current-Limiting Fuse — The rated voltage of the fuse-link should be selected with regard to the following :

- if used on a three-phase earthed system, the voltage rating of the fuse-link should be equal to the highest line-to-line voltage;
- if used on a single-phase system, the voltage rating of the fuse-link should be at least equal to 115 percent of the highest single-phase circuit voltage;

- if used on a three-phase unearthed system, the possible occurrence of one double earth fault with one fault on the supply side and one fault on the load side of the fuse, should be considered, as well as the possibility of interruption of capacitive currents in the case of single phase-to-earth fault. Tests with regard to these conditions are not specified in the relevant parts.

2.3.2 Selection of Rated Voltage of Expulsion and Similar Fuses — This shall be done as follows:

- a) The rated voltage of the fuse-carrier should be selected with due regard to circuit conditions related to voltages at the place where the fuse is to be installed, and
- b) The rated voltage of the fuse-base should not be less than the highest line-to-line service voltage of the multi-phase or single-phase system.

NOTE 1 — Successful completion of the dielectric withstand tests does not insure that fuses providing an isolating distance, when open, will always flashover to earth instead of across the isolating distance.

NOTE 2 — Selection of a higher insulation level than those specified in Part II of this standard is permissible.

2.4 Selection of Class of Fuse

2.4.1 Current Limiting Fuses — According to the type of application fuses are referred to as general purpose fuses or back-up fuses, according to whether they are applied as the sole over-current protection, or used in connection with other over-current devices.

2.4.1.1 General purpose fuse — In order to provide complete over-current protection, a fuse used as a general purpose fuse should be able to break any value of current, up to its rated breaking current that may cause it to melt, but for practical purposes this is interpreted to mean any current value that cause the fuse to melt in at least 1 h.

Currents in the range between the rated current and the one-hour melting current, for which tests are not included in this standard are expected to occur only in special cases (for example single-phase-to-earth faults on unearthed systems).

2.4.1.2 Back-up fuses — Back-up fuses are for use where currents between the rated current and the rated minimum breaking current are interrupted by some other directly associated device or are not likely to be encountered.

It is essential to ensure that the circuit is opened before the flow of current results in difficulties with the fuse.

For fuse-combinations, proper co-ordination between the back-up fuse and the mechanical switching device shall be made to ensure correct operation of the combination over the whole range of currents. This co-ordination shall take into consideration the tripping process of the mechanical switching device either by means of strikers and over-current protective devices or by strikers only.

NOTE — For many applications that in principle require a general purpose fuse, a fault in the current range below the minimum breaking current is extremely rare: a back-up fuse may therefore be successfully used even if the pre-arcing time corresponding to the minimum breaking current is considerably less than 1 h.

2.4.2 Expulsion and Similar Fuses — This shall be done as follows:

- a) *Class 1* : These fuses are generally applicable to the protection of large transformer banks, voltage transformers and power-factor correction capacitor banks on important systems.

They may be used indoors when they include provision for reduction of emission of gases.

- b) *Class 2* : These fuses are generally applicable to the protection of small transformers and small power-factor correction capacitor banks, or for sectionalizing the circuit on outdoor open wire power distribution systems.

NOTE — The values of natural frequencies and amplitude factor may exceed the values specified for instance when fuses are located in the vicinity of a large transformer bank and when the conditions of no parallel loads may exist; such application conditions should be referred to the manufacturer.

2.5 Selection of Insulation Levels

2.5.0 The choice of insulation level shall be made by considering the degree of exposure to lightning and switching over-voltages, the type of system neutral earthing and, where applicable, the type of over-voltage protective device.

2.5.1 Equipment designed according to List 1 of Table 1 of Part I of this standard is suitable for the following installations:

- a) In systems and industrial installations not connected to overhead lines:
- 1) where the system neutral is earthed either solidly or through an impedance which is low compared with that of an arc-suppression coil. Surge protective devices, such as diverters, are generally not required; and
 - 2) where the system neutral is earthed through an arc-suppression coil and adequate over-voltage protection is provided in special systems, for example, an extensive cable network, where surge diverters capable of discharging the cable capacitance may be required.

- b) In systems and industrial installations connected to overhead lines through transformers and where cables or additional capacitors of at least $0.05 \mu\text{F}$ per phase are connected between the transformer lower-voltage terminals and earth, on the transformer side of the fuses and as close as possible to the transformer terminals. This covers the cases:
- 1) where the system neutral is earthed either solidly or through an impedance which is low compared with that of an arc-suppression coil. Over-voltage protection by means of surge diverters may be desirable; and
 - 2) where the system neutral is earthed through an arc-suppression coil and where adequate over-voltage protection by surge diverters is provided.
- c) In systems and industrial installations connected directly to overhead lines :
- 1) where the system neutral is earthed solidly or through an impedance which is low compared with that of an arc-suppression coil and where adequate over-voltage protection by spark gaps or surge diverters is provided depending on the probability of over-voltage amplitude and frequency; and
 - 2) where the system neutral is earthed through an arc-suppression coil and where adequate over-voltage protection by surge diverters is provided.

In all other cases, or where a very high degree of security is required, equipment designed according to List 2 shall be used (see Table 1 of Part I of this standard).

For voltages higher than 72.5 kV it is recommended to draw guidance from IS : 2165 (Parts I to III)-1973* for choice between the alternatives 'full insulation' and 'reduced insulation' for the same rated voltage.

3. OPERATION

3.1 Special care shall be taken to see that the fuse-link is securely locked in the service position.

While replacing fuse-links, it is advisable to remove and to insert fuse-links off-load (see also 0.6). It is also advisable to replace all three fuse-links when the fuse-link on one or two phases of a three phase circuit has operated, unless it is definitely known that over-current has passed through the unmelted fuse-links.

*Insulation co-ordination:

Part I Definitions and basic principles (*first revision*).

Part II For highest voltages for equipment of 100 kV and above (*first revision*).

Part III For highest voltages for equipment above 1 kV and less than 100 kV (*first revision*).